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TR9005

DATA SHEET

Rev 1.1

AMENDMENT HISTORY

Version	Date	Description
1.0	Mar, 2014	New release
1.1	Aug, 2016	Modify functional block diagram

CONTENTS

GENERAL DESCRIPTION

TR9005 is a quad rail-to-rail input and output CMOS operational amplifier with ultra low offset. Features include wide input common-mode voltage range and broad output voltage swing with operating supply voltage from 2.1V to 5.5V. TR9005 provides 1 MHz bandwidth consuming ultra low current of 40 μA per channel. Very low input bias currents enable them ideal for integrators, photodiode amplifiers, and piezoelectric sensors.

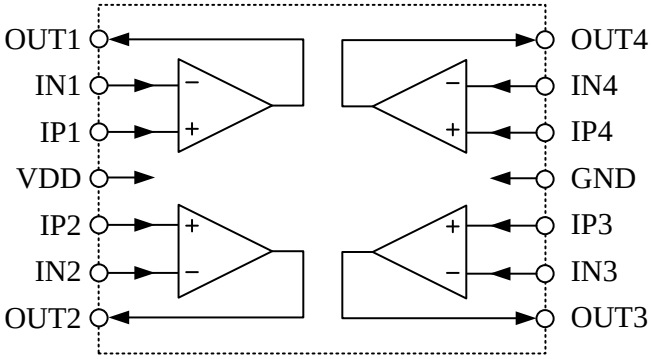
FEATURES

1. Rail-to-Rail Input and Output
2. High input impedance
3. Single supply operation
4. ±0.8 mV Typical offset (Vos)
5. Gain Bandwidth Product: 1 MHz
6. Wide supply range: 2.1V to 5.5V
7. Ultra low power: 40 μA per channel
8. Provides both sink and source output drive capability
9. Pin compatible with LM324 (14-pin DIP)
10. 14-pin DIP/SOP package

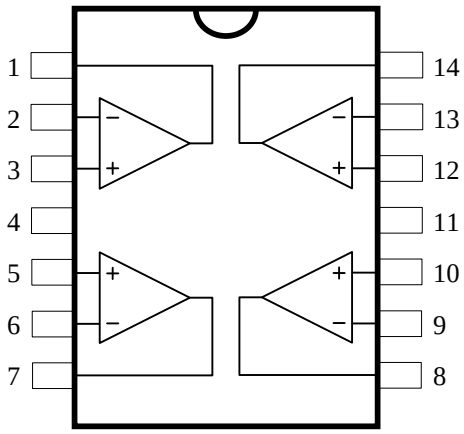
APPLICATION

1. ASIC Input or Output Amplifier
2. Sensor Interface
3. Piezo Electric Transducer Amplifier
4. Medical Instrumentation
5. Audio Output
6. Portable Systems
7. Smoke Detectors
8. Notebook PC
9. Battery-Powered equipment

Functional Block Diagram



Pin Assignment



Pin Description

Pin No.	Pin Name	I/O	Internal Connection	Description
1	OUT1	O	CMOS OUT	Output pin of the op amp 1
2	IN1	I	PMOS IN	Inverting input pin of the op amp 1
3	IP1	I	PMOS IN	Non-inverting input pin of the op amp 1
4	VDD			Positive power supply
5	IP2	I	PMOS IN	Non-inverting input pin of the op amp 2
6	IN2	I	PMOS IN	Inverting input pin of the op amp 2
7	OUT2	O	CMOS OUT	Output pin of the op amp 2
8	OUT3	O	CMOS OUT	Output pin of the op amp 3
9	IN3	I	PMOS IN	Inverting input pin of the op amp 3
10	IP3	I	PMOS IN	Non-inverting input pin of the op amp 3
11	GND			Negative power supply
12	IP4	I	PMOS IN	Non-inverting input pin of the op amp 4
13	IN4	I	PMOS IN	Inverting input pin of the op amp 4
14	OUT4	O	CMOS OUT	Output pin of the op amp 4

Absolute Maximum Ratings

Parameter	Rating	Unit
Supply voltage	-0.3 to +6.0	V
Input voltage	V_{SS} -0.3 to V_{DD} +0.3	
Operating temperature	-20 to +75	°C
Storage temperature	-50 to +125	

Note：These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

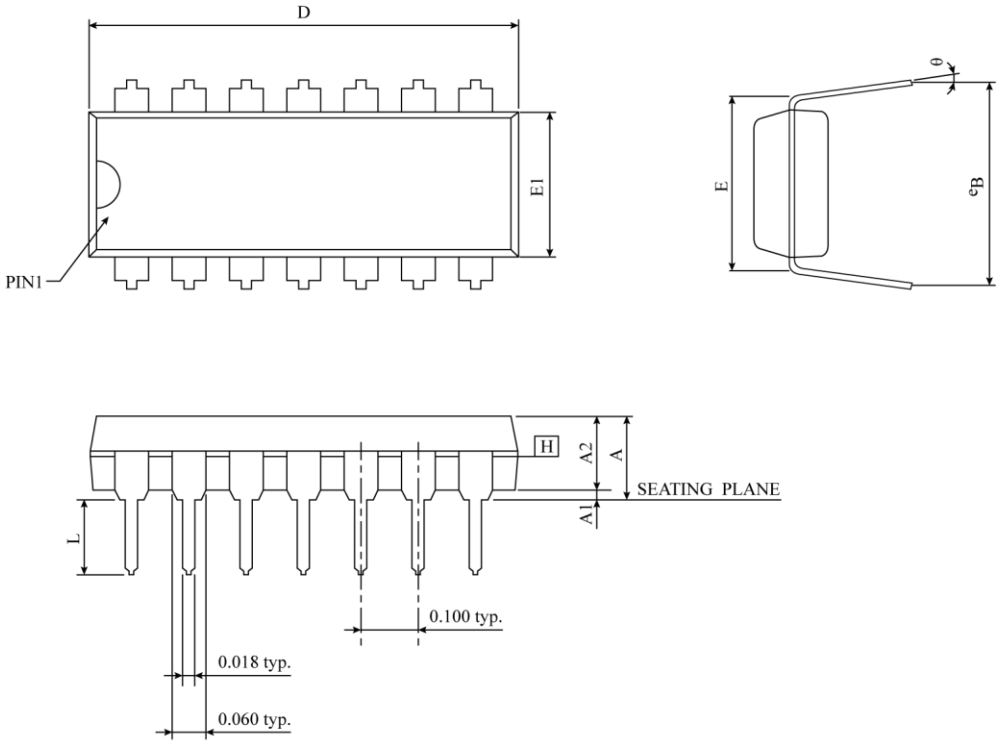
Electrical Characteristics (VDD=5V, Ta=25°C)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
VOS	Input Offset Voltage	Vo=2.5V		±0.8	±3	mv
AVOL	Large Signal Voltage Gain	RL=100KΩ CL=100pF	80	100		dB
GBW	Gain Band Width Product	RL=100KΩ CL=100pF		1		MHz
CMRR	Common Mode Rejection Ratio	Vo=2.5V Vi=2.5V	65	75		dB
PSRR	Power Supply Rejection Ratio	Vo=2.5V	65	85		dB
ICC	Supply Current Per Single Amplifier	Av=1 Vo=2.5V No load		40	50	μA
ICCA	Supply Current for All Amplifiers	Av=1 Vo=2.5V No load		60	80	μA
SR	Slew Rate at Unity Gain	No load		0.6		V/μs
ISCH	Output Short Source Current			25		mA
ISCL	Output Short Sink Current			25		mA

Note: The method to save the current consumption of idle OP Amp is to tie the non-inverting input pin to VDD pin and let the inverting input pin and output pin to be floating.

Package Information

14-pin DIP (300 mil) Outline Dimensions

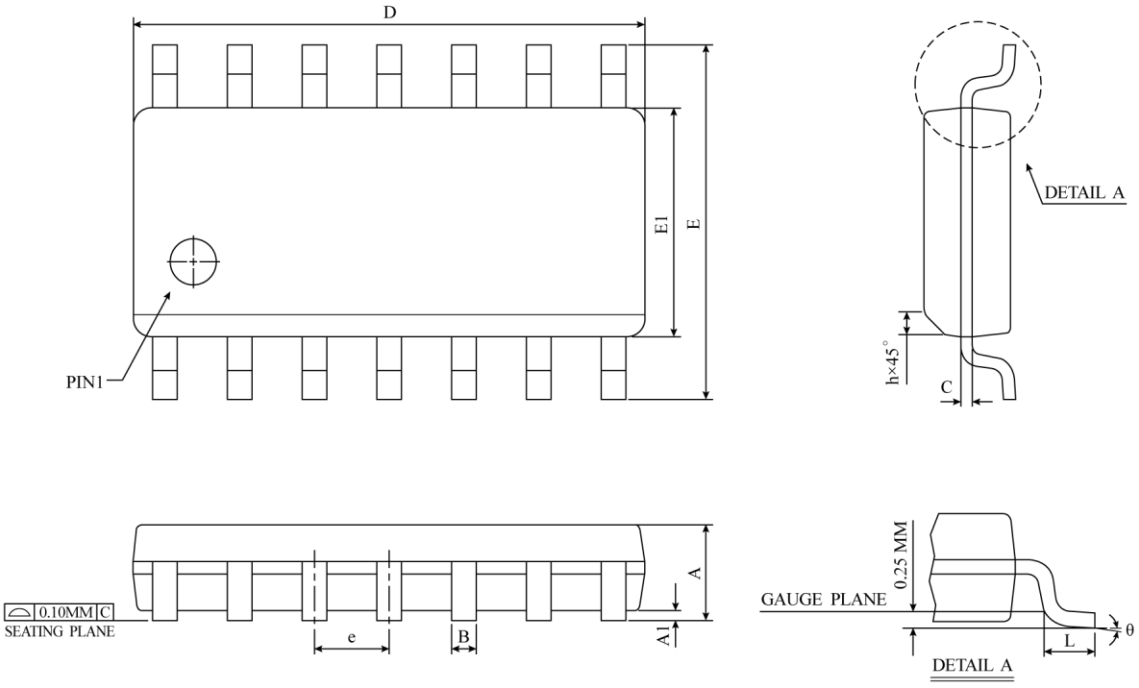


SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	-	-	5.334	-	-	0.210
A1	0.381	-	-	0.015	-	-
A2	3.175	3.302	3.429	0.125	0.130	0.135
D	18.669	19.177	19.685	0.735	0.755	0.775
E	7.620 BSC			0.300 BSC		
E1	6.223	6.350	6.477	0.245	0.250	0.255
L	2.921	3.366	3.810	0.115	0.133	0.150
^{e}B	8.509	9.017	9.525	0.335	0.355	0.375
θ	0°	7.5°	15°	0°	7.5°	15°
JEDEC	MS-001 (AA)					

NOTES：

1. "D" , "E1" DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOTEXCEED .010 INCH.
2. eB IS MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
3. POINTED OR ROUNDED LEAD TIPS ARE PREFERRED TO EASE INSERTION.
4. DISTANCE BETWEEN LEADS INCLUDING DAM BAR PROTRUSIONS TO BE .005 INCH MININUM.
5. DATUM PLANE H COINCIDENT WITH THE BOTTOM OF LEAD, WHERE LEAD EXITS BODY.

14-pin SOP (150 mil) Outline Dimensions



SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	1.55	1.75	0.0532	0.0610	0.0688
A1	0.10	0.18	0.25	0.0040	0.0069	0.0098
B	0.33	0.42	0.51	0.0130	0.0165	0.0200
C	0.19	0.22	0.25	0.0075	0.0087	0.0098
D	8.55	8.65	8.75	0.3367	0.3410	0.3444
E	5.80	6.00	6.20	0.2284	0.2362	0.2440
E1	3.80	3.90	4.00	0.1497	0.1536	0.1574
e	1.27 BSC			0.050 BSC		
h	0.25	0.38	0.50	0.0099	0.0148	0.0196
L	0.40	0.84	1.27	0.0160	0.0330	0.0500
θ	0°	4°	8°	0°	4°	8°
JEDEC	MS-012 (AB)					

⚠ * NOTES : DIMENSION " D " DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL
NOT EXCEED 0.15 MM (0.006 INCH) PER SIDE.